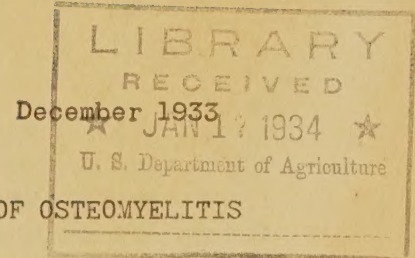


Historic, Archive Document

Do not assume content reflects current
scientific knowledge, policies, or practices.

1. 9
E 183 Pro
*minimum
only, ed only*

E-312 (Series)



PROBLEMS IN THE APPLICATION OF THE MAGGOT TREATMENT OF OSTEOMYELITIS
AND OTHER SUPPURATIVE INFECTIONS

By William Robinson
Division of Insects Affecting Man and Animals
Bureau of Entomology
United States Department of Agriculture

In the Baer maggot treatment (1)* living, sterile maggots are implanted in the surgically prepared wound. The presence of actively functioning maggots within the wound appears to be an essential part of the treatment (6, 8), and no convincing evidence has yet been given that living maggots can be eliminated.

Certain problems of a biological as well as a clinical nature are bound to arise in a treatment of this kind, and the present article is a discussion of these questions from the biological standpoint. As living maggots are an integral part of the treatment, the success of the method depends largely upon the suitability of conditions in the wound to their requirements.

A POSTOPERATIVE TREATMENT

Before maggots are implanted a radical operation is performed to remove dead tissue and to establish adequate drainage. A discussion of the operative procedure employed in cases for maggot treatment is given in a number of published papers (1, 2, 3, 5, 9).

As maggots do not function well in the presence of blood, it is advisable to use vaseline gauze when packing the wound in order to reduce hemorrhage when the packing is removed. Care should be taken to use a minimum quantity of vaseline, so as to leave as little as possible in the wound to interfere with the maggots.

MAGGOTS ARE SURFACE FEEDERS

Maggots feed only on the surface or in shallow openings and do not penetrate deeply into a sinus. It is essential that the maggots be given access to all infected parts. Thorough exposure of the infected tracts at the time of the operation is therefore advised whenever possible, as the maggots cannot be relied upon to reach such areas unaided.

* Underscored numbers in parentheses refer to the literature references given at the end of this circular.

During treatment the wound tends to close in some cases, which forces the maggots to work in the upper parts. Various devices have been used to keep the wound open. Strips of adhesive plaster attached to the outer edges and fastened down so as to pull the wound open have been used in shallow wounds. Metal retractors such as described by Weil (10), which are allowed to remain in the wound, appear to be satisfactory for deep wounds. Buchman* has used blocks of sponge rubber for this purpose with success.

IRRITATION OF THE SKIN AROUND THE WOUND

Under the maggot treatment the wound secretions are usually very abundant and frequently inflame the skin surrounding the wound. For this reason it is customary to protect the skin in some way, because maggots sometimes move about upon the skin within the limits of the cage. This is especially the case if the conditions in the wound are not favorable for them.

A layer of adhesive plaster or a coating of collodion has been tried rather extensively as a wound protection, but neither of these has been found to be generally satisfactory. They both tend to lift off of the skin when they become wet, thus allowing the maggots and the secretions to get in under them. They are also somewhat painful to remove when dressing the wound.

Excellent results in protecting the skin from the crawling of the maggots and the irritations of the wound secretions have been obtained with the liquid "Duo" adhesive, mentioned by Buchman and Blair (2), and with Unna's paste, described by Jewett (4). They can each be removed easily with warm water and they produce no ill effect upon the skin.

IMPLANTATION OF MAGGOTS IN THE WOUND

About 4 to 5 days after the operation, when bleeding usually will have ceased, the vaseline-gauze packing can be removed. The wound is then ready for introduction of maggots. The transference of the maggots from their containers to the wound is, of course, done with care to avoid contaminating them, but it is not necessary to use the aseptic precautions of the operating room. A satisfactory method of implantation is to take the maggots to the bedside or dressing room in their original food bottles. Sterile water is then poured into the bottle and stirred slightly with an applicator. The maggots are next poured on to sterile gauze over a beaker or dressing jar and washed once or twice to separate them from the food. Warm water should not be used, as it activates the maggots and causes them

* Dr. J. Buchman, Hospital for Joint Diseases, New York, N. Y.

to scatter. A final rinse with cold water will subdue them so that they can be transferred to the wound with a sterile tongue depressor, spatula, or spoon. A small quantity of food transferred with the maggots has not been found harmful to the wound. Buchman drops the gauze with the maggots directly into the wound and removes it the next day. If the maggots are brought to the dressing room in bottles free from food, they can be transferred in the same way as described or simply removed from the bottle with a cotton-tipped sterile applicator.

AVOIDANCE OF OVERCROWDING

The number of maggots to be placed in the wound can usually be determined without difficulty after a brief experience. In some of the early cases the wound was filled with young maggots, but this led to considerable trouble. An infected finger-tip may require as few as five or six maggots while for deep femur wounds 800 to 900 may be needed. It is important to avoid filling the wound with maggots. The tendency is to use excessive numbers; but as growth occurs very rapidly, the maggots are often crowded from the wound. This causes them to escape from the cage, if at all possible, and to wander over the skin and get into the bed.

As the wound begins to heal the number of maggots should be reduced. They feed only upon the purulent and necrotic material in the wound which is diminished as healing progresses.

The longer the period that maggots can feed in the wound during any implantation, the greater is their usefulness. For this reason they should be only partly grown when implanted. Probably a length of from 4 to 6 mm is most suitable. Specimens of smaller size are more difficult to transfer and frequently escape.

MAGGOT RETAINERS OVER THE WOUND

A cage or retainer of some sort over the wound is necessary, as the maggots tend to wander for a time after implantation. Fine copper-wire gauze, 60 mesh, was used by Baer (1). The screen was cut the shape of the wound but considerably larger. A strip of sponge rubber was sewn around the lower margin to serve as a cushion. This has been a rather popular type of cage and is still used under various modifications. It can be fastened to the wound in several ways. A strip of adhesive plaster can be folded with the sticky surface outward and placed around the cage so that it adheres both to the rubber and to the edge of the wound. The plaster, however, sometimes irritates the skin and it also tends to loosen and lift from the skin where the drainage flows.

Jewett (4) has used Unna's paste with excellent results for fastening the cage down. His formula for the paste is:

"Zinc oxide,	2½ parts
Gelatin,	6¼ parts
Glycerin,	19 parts
Water,	19 parts

"The solution should not be too thin, or it will run down over the skin and also into the wound, but when of the right consistency it seals the skin very effectively and also keeps the covering of wire or gauze glued down. Of course, it should be applied warm. We have seen no ill effects from a little getting into the wound."

A very simple and convenient retainer is described by Buchman and Blair (2). After implantation the edges of the wound are painted with liquid "Duo" adhesive and a piece of fine muslin is spread over the wound. Besides being easy and quick to apply, this method has the additional advantage of costing considerably less than the wire gauze and rubber arrangement.

For terminal wounds a different type of retainer is necessary. A satisfactory method used by Maddock* is to fasten wooden tongue depressors with adhesive plaster along the sides so that the ends project beyond the wound. Muslin gauze is then gathered over the wound and fastened down with adhesive plaster strips. The strips of wood support the gauze and keep it free of the wound.

MAGGOTS WILL NOT FUNCTION IN ACCUMULATED WOUND SECRETIONS

The serous liquid secreted freely by the wound under maggot treatment causes the wound to become unfavorable for the maggots if it is allowed to accumulate. Excessive secretion in the wound will force the maggots to cease their feeding and attempt to escape, and if they cannot get away they usually die in the wound. This, of course, reduces the efficiency of the treatment; it retards the healing process and adds to the cost of the treatment.

Adequate drainage of the wound is therefore of especial importance in the maggot treatment. A method which is usually satisfactory is to allow the discharge to run out of the wound by gravity wherever this is possible, and this can be provided for at the time of the operation. Other methods are aspiration, sponging, and pipetting, all of which require frequent attention but are sometimes necessary in deep wounds that cannot be completely drained by gravity.

The only way to get the maggots to work in the deeper infected sinuses is to expose these tracts surgically and keep them free from accumulations of pus and other secretions. Otherwise the maggots will be

* Dr. Stephen Maddock, Boston City Hospital, Boston, Mass.

forced to feed along the upper surfaces, thus causing premature healing and development of granulation tissue there, whereas it is admitted that healing of the wound must proceed from the bottom upward. One of the chief reasons for the trouble experienced in the early closing of the wound under the maggot treatment is undoubtedly inadequate drainage.

LIGHT

Maggots have no eyes and do not require light for their activities. They are repelled by light and normally move away from it. A light is sometimes used over the wound, but this is not needed to drive the maggots down into the wound, because they will go down naturally if the wound is favorable for them.

REMOVAL OF MAGGOTS

The length of time to leave maggots in the wound is usually 3 to 5 days, depending partly upon their size when implanted. In nature they leave their food when full grown and finish their development in the ground. It is advisable to remove the maggots from the wound before migration, otherwise they will escape if possible and cause considerable annoyance to the patient. If they cannot escape they will die in the wound. The living maggots are easily removed by washing the wound with sterile water. If any are still feeding deeply they can be extracted with forceps or applicator. It is often advisable to allow the patient a day to rest between implantations.

NUMBER OF IMPLANTATIONS

Typically, as the wound heals it becomes less favorable for maggots, and a time comes when they are no longer useful. This differs, of course, with each case. The cleaning up of the wound and the growth of granulation tissue are indications that the maggot treatment can be reduced or stopped. Maggots require relatively enormous quantities of food (6), and unless it is available they will either escape or die in the wound. As suitable food is lacking in the clean wound, the use of maggots at this time is futile and would cause special annoyance to the patient. The number of implantations which can be used to advantage is therefore limited. It may range from 2 or 3 to 20 or more.

NO DANGER OF PARASITISM

Surgical maggots of the species Lucilia sericata are recommended by the Bureau of Entomology and are commonly used in treatment. They do not attack healthy tissue, but remove only the devitalized tissue, the pyogenic bacteria, and the pus from the wound. They must also leave the wound in order to finish their development. Therefore there is no danger of parasitism within the patient or of injury to the tissues through neglect to remove the maggots. There is grave danger, however, in the use of the screw worm (Cochliomyia macellaria) (7), and that species must be carefully avoided.

SUPPLY OF SURGICAL MAGGOTS

Sterile maggots can be purchased ready for use from certain medical supply houses. The Bureau of Entomology will furnish a list of such companies upon request. Maggots are also being reared privately in large numbers in hospital laboratories, and unless a rather small supply is needed this is usually a less expensive and more convenient way to procure them. It is quite practicable, and the cultural technic is not difficult to learn. The Bureau of Entomology has issued a circular describing approved methods of breeding sterile maggots, and a copy will be sent upon request.

PERSONAL INSTRUCTIONS TO TECHNICIANS

The Bureau of Entomology is prepared to give individual instructions to those interested in receiving training in the laboratory in Washington on the general subject of the culture of surgical maggots. It is desired that persons wishing to visit the laboratory for this purpose will communicate with the Bureau some time in advance.

LIST OF ARTICLES RELATING TO THE MAGGOT TREATMENT

A large number of articles have been published upon the clinical use of maggots. The Bureau of Entomology has compiled a classified list of articles covering several aspects of the subject. Copies of this list will be mailed upon request.

REFERENCES

1. 1931 Baer, W. S. The treatment of chronic osteomyelitis with the maggot (larva of the blowfly). Jour. Bone Joint Surg. 13: 438-475.
2. 1932 Buchman, J., and Blair, J. E. Maggots and their use in the treatment of chronic osteomyelitis. Surg. Gyn. Obst. 55: 177-190.
3. 1931 Child, F. S., and Roberts, E. F. The treatment of chronic osteomyelitis with live maggots. N. Y. State Jour. Med. 31: 937-943.
4. 1933 Jewett, E. L. The use of Unna's paste in the maggot treatment of osteomyelitis. Jour. Bone Joint Surg. 15: 513-515.
5. 1931 Myers, J., and Czaja, L. M. The maggot treatment of osteomyelitis. Illinois Med. Jour. 60: 124-133.

6. 1933 Robinson, W., and Norwood, V. H. The role of surgical maggots in the disinfection of osteomyelitis and other infected wounds. Jour. Bone Joint Surg. 15: 409-412.
7. 1933 Robinson, W. The culture of sterile maggots for use in the treatment of osteomyelitis and other suppurative infections. Circ. E-311 (multigraphed), Bur. Entomology, U. S. Dept. Agr.
8. 1933 Slocum, M. A., McClellan, R. H., and Messer, F. C. Investigation into modes of action of blowfly maggots in the treatment of chronic osteomyelitis. Pa. Med. Jour. 36: 570-573.
9. 1931 Weil, G. C., Nettrour, S., and Rohm, R. Treatment of acute hematogenous osteomyelitis with especial reference to the use of maggots. Pa. Med. Jour. 34: 313-316.
9. 1933 Weil, G. C., Simon, R. J., and Sweadner, W. R. Larval or maggot therapy in the treatment of acute and chronic pyogenic infections. Am. Jour. Surg. 19: 36-48.

